EVALUATION REPORT

Montana Science Assessment Alignment Study
and
Analysis of Depth of Knowledge

Conducted by:

Center for Classroom Teaching and Learning
Northwest Regional Educational Laboratory

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Purpose

The purpose of this study was to examine items from the Grades 4, 8, and 10 Montana Science Assessment developed by Measured Progress for use in the 2007-2008 school year. This alignment study examined two criteria adapted from the work of Norman Webb. Although Webb's model includes four criteria—categorical concurrence, depth of knowledge, balance, and range of knowledge—an examination of only the categorical concurrence and depth of knowledge criteria were possible as the remaining two require more detailed objective statements rather than the broad standards used in this study.

Webb Alignment Model Criteria

Alignment Criterion #1 – Categorical Concurrence

Webb defines alignment as the degree to which expectations and assessments are in agreement and serve in conjunction with one another to guide the system toward students learning what is expected (Webb, 1999).

The criterion of categorical concurrence between standards and assessment is met if the same or consistent categories of content appear in both state standards and assessments. The criterion is judged by examining both the assessments and the standards to determine whether, in fact, the assessment instruments do include items that measure the content of the standards.

Webb assumes that if an assessment instrument contains at least six items measuring the content of a standard, that assessment has attained 'acceptable' categorical concurrence. Six is considered to be the minimum for an assessment to be considered 'acceptable.' For further discussion of Webb's rationale, see page 7 of Webb's *Research Monograph No. 18 – Alignment of Science and Mathematics Standards and Assessments in Four States* published by the National Institute for Science Education and the Council of Chief State School Officers in 1999.

Alignment Criterion #2 – Depth-of-Knowledge (DOK) Consistency

"Depth-of-knowledge consistency between standards and assessment is achieved if what is elicited from students on the assessment is as demanding cognitively as what students are expected to know and do as stated in the standards" (Webb, 1999, page 7). This criterion examines the alignment of the complexity of knowledge required by each of the assessment items with the standards they address.

Webb defines an 'acceptable' level of consistency as at least 50% of the items meeting or exceeding the depth of knowledge level of the objective or standard. A 'weakly met' designation is given when 40 – 49% of the items are consistent with the depth of knowledge (DOK) level of the standard and below 40% is categorized as 'unacceptable.'

Process Description

1. The alignment analysis was conducted by two NWREL professional staff with expertise and experience in science instruction, assessment, and content. Ratings used in calculating alignment for each of the two criteria described above were determined through consensus. In the Webb model, these are determined by averaging the individual rater marks rather than by consensus.

2. The NWREL staff examined the Montana science standards and assessment items provided by the state's assessment contractor, Measured Progress.

3. Through consensus, each assessment item was assigned a DOK level and determined to align with a particular standard. The tables in Appendix A show these designations.

Results and Recommendations

The following tables summarize the results of the NWREL analysis of the alignment of the assessment items with a specific state standard and the congruence between the depth of knowledge of that standard and the items.

Grade 4 Science

Standard	Depth of Knowledge for Standard	Total # of Items for Standard	Percent of Items "At or Above" Depth of Knowledge Level	Meets Depth of Knowledge Test (at least 50% of items at or above DOK for Standard)	Meets Categorical Concurrence Test (at least six items per Standard)
Demonstrate the ability to design, conduct, evaluate, and communicate results and form reasonable conclusions of scientific investigations.	3	11	18%	NO	YES
Demonstrate knowledge of properties, forms, changes, and interactions of physical and chemical systems.	2	14	43%	YES (Weakly)	YES
Demonstrate knowledge of characteristics, structures, and function of living things; the process and diversity of life; and how living organisms interact with each other and their environment.	2	11	27%	NO	YES
Demonstrate knowledge of the composition, structures, processes, and interactions of Earth's systems and other objects in space.	2	15	67%	YES	YES
Understand how scientific knowledge and technological developments impact communities, cultures, and societies.	2	2	50%	YES	NO
Understand historical developments in science and technology.	2	2	100%	YES	NO

Recommendations

Depth of Knowledge

- Add three or four items at DOK Level 3 for Standard 1
- Add one item at DOK Level 2 for Standard 2
- Add two or three items at DOK Level 2 for Standard 3

Categorical Concurrence

- Add four items for Standard 5
- Add four items for Standard 6

Grade 8 Science

Standard	Depth of Knowledge for Standard	Total # of Items for Standard	Percent of Items "At or Above" Depth of Knowledge Level	Meets Depth of Knowledge Test (at least 50% of items at or above DOK for Standard)	Meets Categorical Concurrence Test (at least six items per Standard)
Demonstrate the ability to design, conduct, evaluate, and communicate results and form reasonable conclusions of scientific investigations.	3	12	0%	NO	YES
Demonstrate knowledge of properties, forms, changes, and interactions of physical and chemical systems.	2	14	71%	YES	YES
Demonstrate knowledge of characteristics, structures, and function of living things; the process and diversity of life; and how living organisms interact with each other and their environment.	2	11	9%	NO	YES
Demonstrate knowledge of the composition, structures, processes, and interactions of Earth's systems and other objects in space.	2	14	93%	YES	YES
Understand how scientific knowledge and technological developments impact communities, cultures, and societies.	2	2	0%	NO	NO
Understand historical developments in science and technology.	2	2	50%	YES	NO

Recommendations

Depth of Knowledge

- Add six items at DOK Level 3 for Standard 1
- Add four or five items at DOK Level 2 for Standard 3
- Add two items at DOK Level 2 for Standard 5

Categorical Concurrence

- Add four items for Standard 5
- Add four items for Standard 6

Grade 10 Science

Standard	Depth of Knowledge for Standard	Total # of Items for Standard	Percent of Items "At or Above" Depth of Knowledge Level	Meets Depth of Knowledge Test (at least 50% of items at or above DOK for Standard)	Meets Categorical Concurrence Test (at least six items per Standard)
Demonstrate the ability to design, conduct, evaluate, and communicate results and form reasonable conclusions of scientific investigations.	3	14	14%	NO	YES
Demonstrate knowledge of properties, forms, changes, and interactions of physical and chemical systems.	2	12	42%	YES (Weakly)	YES
Demonstrate knowledge of characteristics, structures, and function of living things; the process and diversity of life; and how living organisms interact with each other and their environment.	2	13	77%	YES	YES
Demonstrate knowledge of the composition, structures, processes, and interactions of Earth's systems and other objects in space.	2	12	67%	YES	YES
Understand how scientific knowledge and technological developments impact communities, cultures, and societies.	2	3	100%	YES	NO
Understand historical developments in science and technology.	2	1	100%	YES	NO

Recommendations

Depth of Knowledge

- Add five items at DOK Level 3 for Standard 1
- Add one item at DOK Level 2 for Standard 2

Categorical Concurrence

- Add three items for Standard 5
- Add five items for Standard 6

APPENDIX A

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Grade 4 Science Assessment Items
Alignment to Standards and Depth of Knowledge Levels

Item	Standard	Depth of Knowledge Level
1	04.S.1	2
2	04.S.1	3
3	04.S.1	2
4	04.S.1	1
5	04.S.1	1
6	04.S.1	1
7	04.S.1	2
8	04.S.1	1
9	04.S.1	1
10	04.S.1	2
11	04.S.1	3
12	04.S.2	1
13	04.S.2	1
14	04.S.2	1
15	04.S.2	2
16	04.S.2	1
17	04.S.2	1
18	04.S.2	2
19	04.S.2	2
20	04.S.2	2
21	04.S.2	1
22	04.S.2	2
23	04.S.2	1
24	04.S.2	1
25	04.S.2	1
26	04.S.3	1
27	04.S.3	2
28	04.S.3	1
29	04.S.3	1
30	04.S.3	1
31	04.S.3	1
32	04.S.3	1
33	04.S.3	1
34	04.S.3	2
35	04.S.3	1
36	04.S.4	3
37	04.S.4	2
38	04.S.4	1

Grade 4 Science Assessment Items
Alignment to Standards and Depth of Knowledge Levels

Item	Standard	Depth of Knowledge Level
39	04.S.4	2
40	04.S.4	3
41	04.S.4	2
42	04.S.4	2
43	04.S.4	1
44	04.S.4	2
45	04.S.4	3
46	04.S.4	1
47	04.S.4	2
48	04.S.4	1
49	04.S.4	2
50	04.S.3	2
51	04.S.5	1
52	04.S.5	2
53	04.S.6	2
54	04.S.4	1
55	04.S.6	2

Grade 8 Science Assessment Items
Alignment to Standards and Depth of Knowledge Levels

Item	Standard	Depth of Knowledge Level
1	08.S.1	2
2	08.S.1	2
3	08.S.1	2
4	08.S.1	1
5	08.S.1	1
6	08.S.1	2
7	08.S.1	2
8	08.S.1	2
9	08.S.1	2
10	08.S.1	2
11	08.S.1	2
12	08.S.2	1
13	08.S.2	2
14	08.S.2	2
15	08.S.2	2
16	08.S.2	2
17	08.S.2	1
18	08.S.2	1
19	08.S.2	2
20	08.S.2	2
21	08.S.2	2
22	08.S.2	2
23	08.S.2	1
24	08.S.2	2
25	08.S.2	2
26	08.S.3	1
27	08.S.3	1
28	08.S.3	1
29	08.S.3	1
30	08.S.3	3
31	08.S.3	1
32	08.S.3	1
33	08.S.3	1
34	08.S.3	1
35	08.S.3	1
36	08.S.3	1
37	08.S.4	2
38	08.S.4	2

Grade 8 Science Assessment Items
Alignment to Standards and Depth of Knowledge Levels

Item	Standard	Depth of Knowledge Level
39	08.S.4	2
40	08.S.4	2
41	08.S.4	2
42	08.S.4	2
43	08.S.4	3
44	08.S.4	2
45	08.S.4	2
46	08.S.4	1
47	08.S.4	2
48	08.S.4	2
49	08.S.4	2
50	08.S.4	2
51	08.S.5	1
52	08.S.5	1
53	08.S.1	2
54	08.S.6	1
55	08.S.6	2

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Grade 10 Science Assessment Items
Alignment to Standards and Depth of Knowledge Levels

Item	Standard	Depth of Knowledge Level
1	12.S.1	2
2	12.S.1	2
3	12.S.1	2
4	12.S.1	2
5	12.S.1	2
6	12.S.1	2
7	12.S.1	2
8	12.S.1	1
9	12.S.1	3
10	12.S.1	2
11	12.S.1	3
12	12.S.1	2
13	12.S.1	2
14	12.S.1	2
15	12.S.2	2
16	12.S.2	1
17	12.S.2	1
18	12.S.2	1
19	12.S.2	1
20	12.S.2	2
21	12.S.2	1
22	12.S.2	2
23	12.S.2	2
24	12.S.2	1
25	12.S.2	1
26	12.S.3	1
27	12.S.3	1
28	12.S.3	3
29	12.S.3	2
30	12.S.3	1
31	12.S.3	2
32	12.S.3	2
33	12.S.3	2
34	12.S.3	2
35	12.S.3	2
36	12.S.3	2
37	12.S.4	1
38	12.S.4	1
39	12.S.4	2

Grade 10 Science Assessment Items
Alignment to Standards and Depth of Knowledge Levels

Item	Standard	Depth of Knowledge Level
40	12.S.4	1
41	12.S.4	3
42	12.S.4	3
43	12.S.4	3
44	12.S.2	2
45	12.S.4	2
46	12.S.3	2
47	12.S.4	3
48	12.S.4	2
49	12.S.4	1
50	12.S.4	2
51	12.S.5	2
52	12.S.5	3
53	12.S.5	2
54	12.S.3	2
55	12.S.6	2

APPENDIX B

KATHLEEN (KIT) M. PEIXOTTO

Primary Areas of Expertise

Program management
Standards-based teaching in science and mathematics education
Professional development
Program evaluation

Education

Basic Administrators License, Leadership 2000 Program, Portland State University,1996
Doctoral Candidate (Ed.D.) in Supervision, University of Louisville, 1992
Master of Arts in Teaching, Natural Sciences, University of Louisville, 1990
Bachelor of Arts, Spanish, University of Puget Sound, 1969

Employment

2003-present   Senior Program Director, Center of Excellence for Classroom Teaching and
               Learning
               Northwest Regional Educational Laboratory

               Director, Northwest Regional Comprehensive Center (2005 – present)
               Director, Region X Comprehensive Center (2004 – 2005)
               Director, Mathematics and Science Education Center (1997 – 2005)
               • Director, Northwest Regional Eisenhower Consortium (2000 – 2005)
               • Provide leadership and management for NWREL's science and
                 mathematics education work including: technical assistance, product
                 development, and resource dissemination

1996   Education Specialist, Office of Curriculum, Instruction and Field Services.
(July – Nov)   Oregon Department of Education.
               • Coordinated final development effort of the state's Common
                 Curriculum Goals and Content Standards prior to their adoption by the
                 State Board of Education. Served as a regional team leader for school
                 improvement visits.

1992-95   Professional Development Associate, Northwest Consortium for Mathematics and
               Science Teaching, Northwest Regional Educational Laboratory
               • Provided professional development activities, research and
                 evaluation to support local, state and national reform efforts in
                 mathematics and science education.

1987-89   Middle School Science Teacher
               Fairfax County Public Schools, Virginia

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1984-87	Middle School Science Teacher Albuquerque School District, New Mexico
1970-71	Junior High Spanish Teacher South Kitsap Schools, Washington

Projects/Activities

Member, Project Steering Committee, Washington State LASER Project, 2005 – present.

Chair, Evaluation Committee of the Eisenhower National Network, 2002 – 2005.

Evaluator, Project TEACH, an NSF funded project at Green River Community College, Auburn, Washington, 1999-2005.

NWREL Liaison, National Awards Program for Effective Teacher Preparation, U. S. Department of Education, 1999-2001.

NWREL Liaison, National Awards Program for Model Professional Development, U. S. Department of Education, 1998-2001.

Evaluator, Oregon Eisenhower Professional Development Program, Oregon Department of Education, 1997-98

Evaluator, Advocates for Women in Science, Engineering and Mathematics (AWSEM), an NSF funded project at Saturday Academy, Oregon Graduate Institute of Technology, 1994-96.

Workshops and Presentations

"Lesson Study: Teachers Learning Together," NSTA Regional Conference, November 2004

"Lesson Study: Improving Teaching Through Collaborative Planning," Idaho Title I Conference, July 2004.

"Adding It Up: What Does the Research Say about Effective Mathematics Instruction?" Montana Title I Conference, February 2004.

"A Performance Assessment Model in Science," Washington Educational Research Association, March 2000

"Alternative Assessment Strategies for Mathematics and Science," Montana Leadership Conference 2000, January 2000

"Administrators Session," Oregon Science Summit, October 1999

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"Meeting the Science Inquiry Benchmarks: What Does It Take?" Oregon Council of School Administrators Annual Conference, June 1999.

"A Research Partnership for Problem Solving in Mathematics," Washington Education Research Association, March 1999

"TIMSS-Third International Mathematics and Science Study," Idaho Council of Mathematics Teachers Fall Conference, October 1997

"Science and Mathematics for All Students: It's just good teaching," Northwest Unity in Diversity '97, April 1997

"School-to-work Transitions: An Opportunity to Promote Gender Equity in Mathematics and Science," Northwest School-to-Work Transition and Tech Prep 2 Conference, April 1995

"Science and Mathematics for All: Developing and Implementing A Shared Vision," National Coalition for Sex Equity in Education Annual Conference, July 1994

"A Vision of Science and Mathematics for All," Keynote Address for Math/Science Strand, National Middle School Association Annual Conference, November 1993

"Factors Affecting Females' Selection of Math and Science Careers," NSTA Annual Convention, April 1993

"Enhancing Science Curriculum Through Performance Assessment," NSTA Annual Convention, March 1992

Publications

High-quality Professional Development: An Essential Component of Successful Schools, with J. Fager, Northwest Regional Educational Laboratory, 1998

The Preparation and Certification of K-12 Mathematics and Science Teachers in the Northwest, contributing author, Northwest Regional Educational Laboratory, 1996

Designing Effective Professional Development in A Toolkit for Professional Developers: Alternative Assessment, with J. Palmer, Regional Educational Laboratory Network Program, 1994

A Vision of Science and Mathematics for All, Northwest Regional Educational Laboratory, 1993

Professional Organizations

Member:
American Educational Research Association
Association for the Education of Teachers in Science
National Science Teachers Association
National Staff Development Council
Phi Delta Kappa

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CATHRYN GARDNER

Primary Areas of Expertise

Education Leadership and Management
Systemic Educational Change
Statewide Systems of Support
School and District Improvement
Parent Involvement
NCLB Title I-A, II-A, V-A
Transforming Teaching and Learning
Teaching of Science

Education

MBA, Education Management, Leicester University, UK, 2003
BEd, Science, Biology and PE, University of Nottingham, UK, 1981
ARRT, Diploma in Radiography, OHSU, OR, 1968

Employment

2007-present   Northwest Regional Comprehensive Center at Northwest Regional Education
(Aug)   Laboratory, Senior Program Advisor.

2005-2007   Education Specialist 2, Oregon Department of Education, Salem, OR
               • Developed and implemented the Statewide System of Support for
                 Oregon
               • Provided technical assistance to districts on Parent Involvement, the
                 Continuous Improvement Process and Plan, School and District
                 Improvement
               • Led federal program monitoring of district compliance

1998-2004   School Improvement Advisor; Solihull LEA, Solihull, UK
               • Led the focus areas of Science, K-12, and Personal and Social
                 Development, K-12 including Performance Reviews of associated
                 teams, national strategies, strategic development planning
               • Led School Self Evaluation
               • Acted as an Improvement and Challenge Advisor for a group of
                 schools in the LEA
               • Lead Science tutor for LEA Teacher Training program

1995-1998   Head of Science Faculty; Alderbrook School, Solihull, UK
               • Planned, implemented, reviewed, and evaluated the 11-18 age range
                 science curriculum and assessment, including A-level courses for
                 university preparation programs

- Designed and supported schools in the implementation of assessment in Science through Scientific Enquiry Skills for 11-18 age range
- Conducted Performance Reviews of all Science faculty staff; member of school leadership team
- Managed science faculty budget

1990-1995   Curriculum Leader, Science and Pastoral Team Coordinator, Stantonbury Campus, Milton Keynes, UK
- Led development and implementation and evaluation of science programs in 11-18 secondary school
- Managed science faculty budget
- Conducted Performance Reviews of all Science faculty staff
- Responsible for pastoral management of year team

1983-1990   Teacher of Science, Guilsborough School, Northants, UK
- Taught Biology, Chemistry and Physics to the 11-18 age range students
- Wrote modules of work for the science curriculum

1981-1983   Biology Tutor, Ejigbo Baptist High School, Ejigbo, Nigeria
- Taught Biology in a 5-19 boarding school

1976-1978   Head of Radiography Training Program, College of Health Sciences, Manama, Bahrain
- Worked with the British Council to implement the first College of Health Sciences in the Middle East, responsible for the Core Curriculum and the Radiography Training program

Professional Organizations

Member:
The Royal Society of Chemistry, [MRSC]
The Institute of Biology [CBiol MIBiol]
The Association for Science Education
The National Association of Inspectors and Advisors for Science
The National Association of Educational Inspectors, Advisors and Consultants

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